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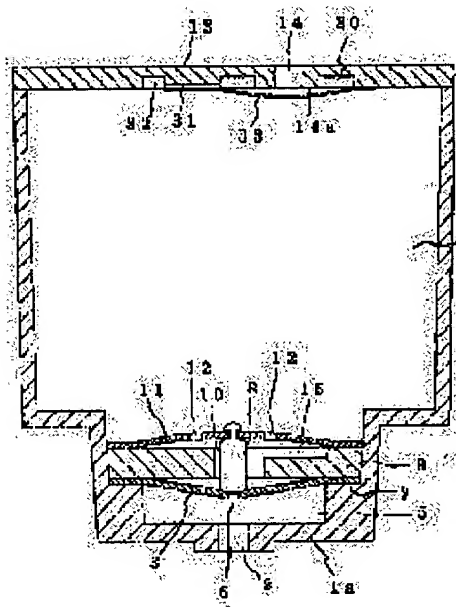
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(54) INK CARTRIDGE FOR INK JET PRINTER



(57)Abstract:

PURPOSE: To stably and effectively supply the ink of an ink chamber to a recording head without using a porous member.

CONSTITUTION: A vessel 1 having an ink supply port 2 at the bottom is so divided as to form an ink chamber 4 at the upper part by a film valve seat 3 made of an elastic thin film having a through hole 6 at the center and an ink supply chamber 5 at the lower part, and a valve disc 8 in contact with the seat 3 by the pressure difference between the chambers 4 and 5 is provided at the position opposed to the hole 6. The seat 3 is received by the differential pressure in a wide area to open a channel from the chamber 4 to the chamber 5 corresponding to the small ink consumption to discharge the ink to a recording head without operating excess negative pressure to the head, and the pressure rising part of the ink supply chamber is absorbed to the ink chamber by the deformation of the seat.

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**CLAIMS**

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[Claim(s)]

[Claim 1] The ink cartridge for ink jet printers which comes to prepare the valve element which said film valve seat contacts by the differential pressure of said ink room and said ink supply room in the location which counters said through-hole while dividing so that an ink room may be formed in the upper part and an ink supply room may be formed in the lower part by the film valve seat which consists the container which equipped the base with the ink feed hopper of an elastic thin film which equipped the core with the through-hole.

[Claim 2] The ink cartridge for ink jet printers of claim 1 which expands spherically so that said film valve seat may be on said ink supply room side with a convex when the pressure of said ink supply room declines beyond a predetermined value rather than the pressure of said ink room.

[Claim 3] Said valve element is the ink cartridge for ink jet printers of claim 1 always oppressed by the film valve seat to the fixed minimum location with the elastic grant means.

[Claim 4] The ink cartridge for ink jet printers of claim 3 said whose elastic grant means is elastic membrane.

[Claim 5] The ink cartridge for ink jet printers of claim 3 said whose elastic grant means is a spring.

[Claim 6] The ink cartridge for ink jet printers of claim 1 in which the piece of positioning is prepared so that said valve element may become perpendicular to said film valve seat.

[Claim 7] The ink cartridge for ink jet printers of claim 1 in which the oil-level stabilization film which consists of film of ink permeability so that said valve element may be made to penetrate and said film valve seat may be followed is prepared.

[Claim 8] The ink cartridge for ink jet printers of claims 1 and 3 said whose elastic thin films are rubber membrane or giant-molecule elastomer film.

[Claim 9] The ink cartridge for ink jet printers of claim 1 by which said valve element is being fixed to the valve assembly.

[Claim 10] It is the ink cartridge for ink jet printers of claim 1 which the flexible film which closes said atmospheric-air free passage hole is stretched at said ink room side when an atmospheric-air free passage hole is prepared in the upper part of said ink room, and it always separates from said free passage hole and ink is contacted, and said ink room connects to said atmospheric-air free passage hole through a capillary.

[Claim 11] The ink cartridge for ink jet printers of claim 10 which said capillary consists of by closing the rill formed in the lid of said container, and the front face of this by said flexible film.

[Claim 12] The ink cartridge for ink jet printers of claim 1 in which the electric shielding valve closed when the ink of said ink supply room decreases in said ink feed hopper is prepared.

[Claim 13] The ink cartridge for ink jet printers of claim 12 which consists of valve guard plates

with which said electric shielding valve catches the conic valve seat extended to an ink supply room side, a spherical float valve, and said float valve to the space of said valve seat.

[Claim 14] The ink cartridge for ink jet printers of claim 1 in which the electric shielding valve closed when it opens to said ink feed hopper when a recording head is equipped, and it is removed from a recording head is prepared.

[Claim 15] The ink cartridge for ink jet printers of claim 14 constituted by said latching valve inserting in said ink feed hopper the valve element which moves to said ink supply room side by insertion of an ink supply needle.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink cartridge suitable for equipping the carriage which carries an ink jet type recording head.

[0002]

[Description of the Prior Art] An ink jet printer carries the ink cartridge which supplies ink for the ink jet type recording head which a pressure is impressed [ recording head ] to the pressure generating room which is open for free passage to a common ink room and a common nozzle orifice, and makes an ink droplet breathe out from a nozzle orifice to carriage and a recording head, and making carriage reciprocate, it is made in agreement with print data, and it is constituted so that a record form may be made to breathe out an ink droplet.

[0003] By the way, since the nozzle orifice of a recording head is located in a part lower than the liquid ink side of an ink cartridge, in order that a head may act on a nozzle orifice, a porous body is usually held in an ink cartridge, and it constitutes so that the pressure of an ink cartridge may become low a little rather than a nozzle orifice with the surface tension by the porous body, and the measures which the ink from a nozzle orifice oozes and prevent \*\* are taken.

[0004] However, when the amount of the ink which consumption of ink progresses and is absorbed by the porous body decreases, the surface tension of a porous body becomes large, supply of the ink to a recording head becomes easy to be overdue, and there is a problem that the ink in a cartridge cannot be consumed completely. Moreover, since the ink of the part of the substantial volume of a porous body which can be held in a cartridge decreases, there is a problem that an ink cartridge is enlarged.

[0005] When the wall which equipped the lower part of an ink tank with the through-hole separates into an ink reservoir and a cavity as shown in the U.S. Pat. No. 4,677,447 specification (JP,62-231759,A), an AMBURERA check valve is prepared in this through-hole movable and ink \*\* of a recording head falls in order to solve such a problem for example, the ink cartridge for ink jet recording heads constituted so that a bulb might be made to open, a cavity might be made to discharge the ink of a tank reservoir and a recording head might be supplied is proposed.

[0006]

[Problem(s) to be Solved by the Invention] According to this, since it becomes unnecessary to hold a porous body in a cartridge, it becomes possible to enlarge substantial ink capacity of a tank, but generally an AMBURERA check valve has the big problem of the amount of offset being too large, and causing fluctuation to the ink amount of supply and causing deterioration of a quality of printed character for adjusting supply of the ink to a recording head to a precision.

[0007] After the AMBURERA check valve has closed the valve on the other hand Since an ink reservoir and a recording head are intercepted completely, the ink of a cavity by change of environmental temperature 2 thru/or when cubical expansion is carried out 5% In the condition that the pressure of a cavity rises and damage the seal of an end connection with a recording head, and ink is revealed and the recording head is equipped This pressure acts on a recording head as it is, it becomes impossible to maintain the negative pressure between a recording head and an ink tank, and there is a problem that leakage of ink arises from a recording head.

[0008] Furthermore, in the differential pressure of dozens mmAq extent which should be maintained in order to perform stable ink supply to a recording head, since an AMBURERA check valve has the weak clausilium force, it opens following rocking of the ink by migration of carriage, and has the problem that stable printing is impossible.

[0009] The place which this invention is made in view of such a problem, and is made into the purpose Ink can be certainly supplied for the negative pressure which was suitable for printing between recording heads, without having certainly followed the minute differential pressure between recording heads, and being influenced by rocking of the ink by migration of carriage to maintenance \*\*\*\*\*. It is offering the ink cartridge which can furthermore prevent leakage of the ink from the ink feed hopper by the temperature change, and leakage of the ink from a recording head.

[0010]

[Means for Solving the Problem] While dividing so that an ink room might be formed in the upper part and an ink supply room might be formed in the lower part by the film valve seat which consists the container which equipped the base with the ink feed hopper of an elastic thin film which equipped the core with the through-hole in this invention in order to solve such a problem, said film valve seat prepared the valve element which contacts by the differential pressure of said ink room and said ink supply room in the location which counters said through-hole.

[0011]

[Function] When ink is supplied to a recording head and the pressure of an ink supply room rises by a temperature rise etc., without a film valve seat's opening the passage from an ink room to an ink supply room in response to differential pressure corresponding to consumption of slight ink in a large area, and making too much negative pressure act on a recording head, a film valve seat follows, a part for a pressure buildup is missed in an ink room, and leakage of the ink from a recording head is prevented. Moreover, it sticks with a valve element with own elasticity of a film valve seat, and closing motion of the valve portion material by rocking of carriage is prevented certainly.

[0012]

[Example] Then, based on the example illustrating the detail of this invention, it explains below. Drawing 1 shows one example of this invention, the sign 1 in drawing is the container which constitutes an ink cartridge body, and the ink feed hopper 2 in which the ink supply needle of a recording head is inserted is formed in base 1a, and the space in a container is divided into the ink room 4 and the ink supply room 5 by the film valve seat 3 mentioned later.

[0013] 3 is the above-mentioned film valve seat, it drills a through-hole 6 in the center, is constituted by elastic membrane equipped with endurance to ink, such as rubber membrane and macromolecule elastomer film, and is stretched by the level difference section 7 formed in the lower part of a container 1.

[0014] 8 is constituted so that it may be inserted in the through-hole 10 which is a valve element

and is prepared in the valve assembly 9 movable up and down, and it may have the size which can secure the gap which is extent which can make it flow down ink and die length may become long a little rather than the thickness of the valve assembly 9, and the film valve seat 3 is made for the valve element supporter material 11 later mentioned so that the lower part may always close the through-hole 6 of the film valve seat 3 to \*\*\*\* it. The ink passage 15 which leads ink to the valve assembly 9 is formed.

[0015] It is the above-mentioned valve element supporter material, and while it is stretched by the front face of the valve assembly 9 and the film valve seat 3 is made to always \*\*\*\* a valve element 8, 11 restricts that a valve element 8 descends rather than a fixed location, and it is constituted so that the crowning of a valve element 8 may be held by the through-hole, while drilling a through-hole 12 in the elastic membrane which consists of an ingredient equivalent to the film valve seat 3.

[0016] The closure of the container 1 is carried out by the covering device material 13 equipped with the atmospheric-air free passage hole 14 in the top face. The rill 31 which constitutes the capillary which connects these with the crevice 30 which encloses this free passage hole 14, and the free passage opening 32 which separates a fixed distance and is located from this crevice 30 is formed in the ink room side of the covering device material 13. When the covering device material 13 is located in the top face of these crevices 30 and a slot 31 up, the flexible film 33 which slacked extent which separates from a through-hole is stretched.

[0017] These film valve seat 3, the valve element base material 11, and a valve element 8 are preferably attached and constituted by the valve assembly 9 at one, carry out invagination to the level difference section 7 of a container 1, and are included in the container 1.

[0018] In this example, if a container 1 is leaned and the ink of the ink room 4 contacts the covering device material 13, in order that the flexible film 33 may contact heights 14a around a through-hole 14 in response to the pressure of ink, the closure of the through-hole 14 is carried out, and leakage \*\*\*\* of the ink from the atmospheric-air free passage hole 14 is prevented.

[0019] If the ink feed hopper 2 is inserted in the ink supply needle of a recording head carried in carriage, the ink supply room 5 and a recording head will be connected. In this condition, since the flexible film 33 of the covering device material 13 hangs down with gravity and a through-hole 14 is opened wide, the ink room 4 is open for free passage with atmospheric air through a crevice 30, a slot 31, and the free passage hole 32.

[0020] If printing is performed and an ink droplet carries out the regurgitation from a recording head in this condition, the ink of the ink supply room 5 will flow into a recording head from the ink feed hopper 2, and the pressure of the ink supply room 5 will decline gradually. The film valve seat 3 descends corresponding to the pressure drop of the ink supply room 5, expanding in the shape of [ which has a radius R with the elasticity in response to the pressure from the ink room 4 ] the spherical surface. At this time, it prevents that prevent the influx of the ink from the ink room 4 to the ink supply room 5, and the pressure of the ink supply room 5 rises too much, preventing that the pressure of the ink supply room 5 declines too much, since a valve element 8 follows the film valve seat 3 ( drawing 2 (\*\*)). Thereby, the pressure of a recording head is maintained by the fixed negative pressure condition to the ink room 4.

[0021] If consumption of the ink in a recording head furthermore progresses and the film valve seat 3 descends much more, since it will be prevented that a valve element 8 descends below in a fixed location by the valve element supporter material 11, a valve element 8 separates from the film valve seat 3 very only ( drawing 2 (\*\*)). Thereby, the ink of the ink room 4 flows into the ink supply room 5 from a through-hole 6 via the narrow gap formed between the valve element 8

and the film valve seat 3.

[0022] If the pressure of the ink supply room 5 rises a little by the inflow of ink, the film valve seat 3 will move to a valve element 8 side with own elasticity, it will \*\*\*\* to a valve element 8, and a through-hole 6 will be closed by the inferior surface of tongue of a valve element 8. Thereby, the influx of the ink of ink supply room 5 HE stops from the ink room 4. Consequently, there is no \*\*\*\* in the amount of the ink of the ink room 3, and the pressure of the ink feed hopper 2 will be maintained uniformly.

[0023] Hereafter, whenever the pressure of the ink supply room 6 declines a little, the film valve seat 3 expands caudad a little, a gap is formed between valve elements 8, and the ink of the ink room 3 is made to flow into the ink supply room 5 from this gap. Thus, since the film valve seat 3 formed by elastic membrane attaches and detaches to a valve element 8 to compensate for consumption of ink, if the elasticity of the film valve seat 3 is set as suitable magnitude, it not only can make very small the pressure at the ink supply initiation time and the differential pressure at the ink supply interruption time, i.e., offset, but it will become possible to discharge all the ink of the ink room 4 to a recording head.

[0024] On the other hand, although the pressure of the ink supply room 5 rises in the condition that printing is interrupted when environmental temperature rises, it moves to the ink room 4 side where the film valve seat 3 is wide opened by atmospheric air following this pressure. Leakage of the ink from the recording head which it is prevented that the pressure of the ink supply room 5 rises, it is concerned with a temperature rise by this, and the negative pressure [ be / nothing ] optimal between recording heads is maintained, therefore originates in a pressure buildup will be prevented.

[0025] Drawing 3 is constituted from rubber membrane from which it is 0.04mm in thickness as a film valve seat 3, and the field in which it is possible, an effective diameter, i.e., elastic deformation, serves as a diameter of 20mm. Moreover, it is what shows the water head value change of the ink cartridge of this invention which set up the minimum location of a valve element 8 so that the radius R of the spherical surface in just before outflow (i.e., the critical state with a valve element 8) ( drawing 2 (\*\*)) might be set to 26mm. Also when a lot of ink of 5g/m is supplied, the increment in a water head value is small, and it turns out that ink can be supplied smoothly, without making too much negative pressure act on a recording head also to a lot of ink consumption by the recording head.

[0026] on the other hand, in closing the ink feed hopper 2 with a seal 16 in a production process, making negative pressure act on the ink room 4 and eliminating the air in a cartridge Since the pressure of the ink room 4 declines rather than the ink supply room 5, and a valve element 8 resists the elastic force of the valve element supporter material 11, moves to an ink room side and forms space between the film valve seat 3 and a valve element 8 as shown in drawing 2 (Ha) There is no \*\*\*\* in existence of the film valve seat 3 and a valve element 8, and the air of the whole cartridge can be eliminated and it becomes possible to fill up the whole cartridge with ink including the ink supply room 5.

[0027] When drawing 4 shows other examples of a valve element 8 and the inferior surface of tongue of a valve element 8 contacts the film valve seat 3 in this example, the plate-like piece 35 of positioning which contacts the top face of the valve assembly 9 is formed.

[0028] According to this example, in the condition that the valve element 8 is in contact with the film valve seat 3, the piece 35 of positioning contacts the top face of the valve assembly 9, and since a valve element 3 is supported by the valve assembly 9 and a perpendicular posture is maintained as much as possible, the through-hole 6 of the film valve seat 3 can be certainly

closed also to vibration by movement of carriage etc.

[0029] The minimum location is prescribed by when the piece 36 of positioning which drawing 5 shows other examples of this invention, and the sign 20 in drawing is a valve element, and was inserted in valve element hold room 9a formed in the valve assembly 9 in the condition of always having been caudad oppressed with the spring 21, and was formed in heights 9b of the lower part of valve element hold room 9a at the valve element 20 contacts. In addition, the signs 22 and 23 in drawing show the through-hole which connects the ink room 4 and the ink supply room 5, respectively.

[0030] In this example, the film valve seat 3 descends corresponding to the pressure drop of the ink supply room 5, expanding in the shape of [ which has a radius R with that elasticity in response to the pressure from the ink room 4 ] the spherical surface. At this time, the influx of the ink from the ink room 4 to the ink supply room 5 is prevented, preventing that the pressure of the ink supply room 5 declines too much, since a valve element 20 follows the film valve seat 3 with the elasticity of a spring 21 and the piece 36 of positioning is held in contact with heights 9b at a posture with a perpendicular valve element 20 ( drawing 6  $R > 6$  (\*\*)). Thereby, there is no \*\*\*\* in rocking by migration of carriage, and since the film valve seat 3 contacts a valve element 20, the ink pressure of a recording head is maintained by the fixed negative pressure condition to the ink room 4.

[0031] If consumption of the ink in a recording head progresses and the film valve seat 3 descends much more, since it will be prevented that a valve element 20 descends below in a fixed location by projection 9b of valve element hold room 9a, a valve element 8 separates from the film valve seat 3 very only ( drawing 6 (\*\*)). Thereby, the ink of the ink room 4 flows into the ink supply room 5 from a through-hole 6 via the narrow gap formed between the valve element 8 and the film valve seat 3.

[0032] If the pressure of the ink supply room 5 rises a little by the inflow of ink, the film valve seat 3 will move to a valve element 20 side with own elasticity, it will \*\*\*\* to a valve element 20, and a through-hole 6 will be closed by the inferior surface of tongue of a valve element 8. Thereby, the influx of the ink of ink supply room 5 HE stops from the ink room 4. Consequently, there is no \*\*\*\* in the amount of the ink of the ink room 3, and the pressure of the ink feed hopper 2 will be maintained uniformly.

[0033] on the other hand, in closing the ink feed hopper 2 with a seal 16 in a production process, making negative pressure act on the ink room 4 and eliminating the air in a cartridge Since the pressure of the ink room 4 declines rather than the ink supply room 5, and a valve element 8 resists a spring 21, moves to an ink room side and forms a gap between the film valve seat 3 and a valve element 20 as shown in drawing 6 (Ha) There is no \*\*\*\* in existence of the film valve seat 3 and a valve element 20, and the air of the whole cartridge can be eliminated and it becomes possible to fill up the whole cartridge with ink including an ink supply room.

[0034] In addition, although he is trying to incorporate the elastic member which makes a valve element 20 contact the film valve seat 3 into the valve assembly 9, as shown in drawing 7 , a valve element 37 is formed in a bamboo hat type, capping 37a is operated as the piece of positioning, and a stopper, and you may make it oppress top-most vertices to the film valve seat 3 side with a spring 38 in an above-mentioned example.

[0035] Since a valve element 37 and a spring 38 can be attached from the exterior of the valve assembly 9 according to this example, simplification of assembly operation can be attained.

[0036] In addition, although he is trying to prepare a spring in a valve element up in an above-mentioned example As shown in drawing 8 , the diaphragm 41 equipped with through-hole 41a



separates a container 40 into the ink room 42 and the ink supply room 43. In the ink supply room 43 The film valve seat 44, The valve element 46 which consists of supporter 46b which is perpendicularly prolonged from spherical-surface 46a which closes the through-hole 45 of the film valve seat 44 on the inferior surface of tongue, and spherical-surface 46a, and penetrates the through-hole 45 of the film valve seat 44 is held. Even if it supports supporter 46b through the spring 47 always oppressed caudad, it is clear to do the same operation so. In addition, the sign 48 in drawing fits in with the lower limit of supporter 46b, and 49 shows [ a valve element 46 ] an ink feed hopper to a perpendicular posture for a positioning guide hole again.

[0037] According to this example, since it is concerned with the buoyancy in ink in order to lengthen that lower part caudad with a spring 47, and a posture is stabilized that there is nothing, are concerned, and there is no valve element 46 in rocking by migration of carriage, and it can supply ink to a recording head at stability.

[0038] Drawing 9 shows other examples of this invention, it consists of film of the porous body of the elasticity nature of extent which the sign 50 in drawing is the oil-level stabilization film, and can follow migration of the film valve seat 3, and grid-like film, the through-hole 51 which fits into a valve element 8 is formed in the field which counters a valve element 8, and a perimeter is fixed to an assembly 9, and the center section is fixed to the valve element 8.

[0039] In this example, if the pressure of the ink supply room 5 declines by consumption of consumption of ink, the film valve seat 3 separates from a valve element 8, and the ink of the ink room 4 will pass the oil-level stabilization film 50, and will flow into the ink supply room 5.

[0040] Although it will originate in migration of carriage and ink will rock violently by about eight valve element if consumption of ink furthermore progresses and the oil level of the ink room 4 falls to about nine assembly, after pressure fluctuation is suppressed as much as possible with the oil-level stabilization film 50, the through-hole 6 of the film valve seat 3 will be passed, and ink \*\* of a recording head is kept constant with respect to reduction of the amount of ink of the ink room 4 that there is nothing.

[0041] In addition, although he is trying to make a valve element \*\*\*\* to the film valve seat 3 using an elastic means in an above-mentioned example, if the elastic force of film valve seat 3 self is used positively, the elastic member made to \*\*\*\* a valve element to the film valve seat 3 can be made unnecessary. Drawing 10 shows one example which made unnecessary the elastic member which oppresses a valve element to a film valve seat, it is a film valve seat, and a through-hole 25 is formed in the valve element 28 mentioned later and the field which counters, and the sign 24 in drawing is being fixed with the valve assembly 27 in the perimeter. 28 is a valve element, and it is being fixed to migration impossible so that it may become a posture perpendicular to the valve assembly 27. In addition, the sign 29 in drawing shows the through-hole which connects the ink room 4 and the ink supply room 5.

[0042] In this example, when the differential pressure of the ink room 4 and the ink supply room 5 is below a predetermined value, since the film valve seat 24 \*\*\*\* a through-hole 25 to a valve element 28 with own elasticity, the flow of the ink of ink supply room 5 HE stops from the ink room 4.

[0043] On the other hand, when a through-hole 25 will separate from a valve element 28, ink will flow into the ink supply room 5 from the ink room 4, supply of ink will progress and the pressure of the ink supply room 5 will rise in order to descend, while the film valve seat 24 expands in the shape of the spherical surface if the pressure of the ink supply room 5 declines, the film valve seat 24 overcomes differential pressure, \*\*\*\* to a valve element 28, and stops the outflow of ink.

[0044] By the way, if air infiltrates into a recording head, in order for the pressure for making an ink droplet breathe out to be absorbed by the air bubbles which originated in air and were generated in the passage of a recording head and to cause poor printing, it is necessary to prevent air absorption of the recording head at the time of ink termination of an ink cartridge.

[0045] Drawing 11 shows one example of the ink cartridge which prevented permeation of the air to the recording head at the time of ink termination of such a recording head, and forms in the connection field of the ink feed hopper 52 and the ink supply room 53 the conic valve seat 54 which the upper part extends, while holding the spherical float valve 55 which comes floating here by buoyancy, the valve guard plates 56, such as a network which can penetrate ink, are formed, and an electric shielding valve constitutes the upper part. In addition, the sign 57 in drawing shows the film valve seat which controls the inflow of the ink from an ink room in contact with a valve element 58.

[0046] This example sets, in the condition that the recording head is equipped with the ink cartridge, it will be in the condition that the float valve 55 stuck to the valve guard plate 56 by buoyancy, the ink feed hopper 52 is opened wide, and supply of the ink to a recording head is performed.

[0047] On the other hand, if consumption of the ink of a cartridge progresses and the water level of ink falls to about 52 ink feed hopper, a float valve 55 will lose the buoyancy in ink, and will contact a valve seat 54 (condition shown by the dotted line among drawing). Therefore, though printing progresses further, since the closure of the ink feed hopper 52 is carried out, permeation of the air to a recording head is prevented and generating of a printing failure can be prevented beforehand.

[0048] Moreover, although it does not insert until it is all consumed in the ink of an ink room if a recording head is usually equipped with an ink cartridge, it may be extracted from a recording head by the actuation which was still mistaken. Thus, once the cartridge with which it was equipped is extracted from a recording head, the ink feed hopper 2 will be wide opened by atmospheric air, air will trespass upon an ink supply room or an ink room, and it will have a bad influence on record actuation.

[0049] Drawing 12 shows the example for preventing above-mentioned un-arranging resulting from attachment and detachment of an ink cartridge, the sign 60 in drawing is the valve element which can be expanded and contracted and which was prepared in the ink feed hopper 61, and the ink supply needle fitting hole 62 with which the ink supply needle 70 fits into the lower part is formed. Moreover, when it moves to an upper limit location, the through-hole 64 which connects the ink supply room 63 and the ink supply needle fitting hole 62 is drilled.

[0050] In this example, as shown in drawing 12 (b), a valve element 60 \*\*\*\* with elasticity to pars-basilaris-ossis-occipitalis 63a of the ink supply room 63, and the outflow of the ink from the ink supply room 63 is always prevented certainly.

[0051] If the ink supply needle 70 is inserted in the fitting hole 62, a valve element 60 will develop even in an upper limit location, and it will separate from base 63a of the ink supply room 63, and the free passage hole 64 will be exposed to the ink supply room 63 (this drawing (\*\*)). The ink supply room 63 and ink passage 70a of the ink supply needle 70 will be connected through the free passage holes 64 and 70b by this, the ink of the ink supply room 63 will flow into the ink supply needle 70, and ink will be supplied to a recording head.

[0052] If the ink cartridge with which the recording head was equipped is removed, since a valve element 60 will move caudad and will intercept the ink supply room 63 and the ink feed hopper 61 (this drawing (\*\*)), the outflow of the ink from the ink supply room 63 and permeation of the

air to the ink supply room 63 will be prevented.

[0053]

[Effect of the Invention] As mentioned above, while dividing so that an ink room may be formed in the upper part and an ink supply room may be formed in the lower part by the film valve seat which consists the container which equipped the base with the ink feed hopper of an elastic thin film which equipped the core with the through-hole in this invention as explained Since the valve element was prepared in the location which counters a through-hole and a film valve seat flows out of an ink room in response to differential pressure corresponding to consumption of slight ink in a large area, Ink can be supplied to a recording head, without making too much negative pressure act on a recording head. When a recording head not only being made to discharge the ink of an ink room without futility but temperature rises greatly in the condition that printing is interrupted A part for the pressure buildup of the ink supply room which a film valve seat displaces to an ink room side, and is opening for free passage with the recording head can be missed in an ink room. Printing which maintained the negative pressure which could prevent leakage of the ink at the time of intact, and was suitable for printing between recording heads at the time of wearing to a recording head, and was stabilized can be made to perform.

[0054] Since adhesion with a valve element is furthermore securable with the elasticity of a film valve seat, are concerned and there is nothing to rocking of the ink of the ink room resulting from migration of carriage, and a valve function can be made to be able to discover certainly, it can be concerned with migration of carriage, differential pressure with a recording head can be maintained uniformly that there is nothing, and improvement in a quality of printed character can be aimed at.

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## TECHNICAL FIELD

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[Industrial Application] This invention relates to the ink cartridge suitable for equipping the carriage which carries an ink jet type recording head.

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## PRIOR ART

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[Description of the Prior Art] An ink jet printer carries the ink cartridge which supplies ink for the ink jet type recording head which a pressure is impressed [ recording head ] to the pressure generating room which is open for free passage to a common ink room and a common nozzle orifice, and makes an ink droplet breathe out from a nozzle orifice to carriage and a recording head, and making carriage reciprocate, it is made in agreement with print data, and it is constituted so that a record form may be made to breathe out an ink droplet.

[0003] By the way, since the nozzle orifice of a recording head is located in a part lower than the liquid ink side of an ink cartridge, in order that a head may act on a nozzle orifice, a porous body is usually held in an ink cartridge, and it constitutes so that the pressure of an ink cartridge may become low a little rather than a nozzle orifice with the surface tension by the porous body, and the measures which the ink from a nozzle orifice oozes and prevent \*\* are taken.

[0004] However, when the amount of the ink which consumption of ink progresses and is absorbed by the porous body decreases, the surface tension of a porous body becomes large,

supply of the ink to a recording head becomes easy to be overdue, and there is a problem that the ink in a cartridge cannot be consumed completely. Moreover, since the ink of the part of the substantial volume of a porous body which can be held in a cartridge decreases, there is a problem that an ink cartridge is enlarged.

[0005] When the wall which equipped the lower part of an ink tank with the through-hole separates into an ink reservoir and a cavity as shown in the U.S. Pat. No. 4,677,447 specification (JP,62-231759,A), an AMBURERA check valve is prepared in this through-hole movable and ink \*\* of a recording head falls in order to solve such a problem for example, the ink cartridge for ink jet recording heads constituted so that a bulb might be made to open, a cavity might be made to discharge the ink of a tank reservoir and a recording head might be supplied is proposed.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] As mentioned above, while dividing so that an ink room may be formed in the upper part and an ink supply room may be formed in the lower part by the film valve seat which consists the container which equipped the base with the ink feed hopper of an elastic thin film which equipped the core with the through-hole in this invention as explained Since the valve element was prepared in the location which counters a through-hole and a film valve seat flows out of an ink room in response to differential pressure corresponding to consumption of slight ink in a large area, Ink can be supplied to a recording head, without making too much negative pressure act on a recording head. When a recording head not only being made to discharge the ink of an ink room without futility but temperature rises greatly in the condition that printing is interrupted A part for the pressure buildup of the ink supply room which a film valve seat displaces to an ink room side, and is opening for free passage with the recording head can be missed in an ink room. Printing which maintained the negative pressure which could prevent leakage of the ink at the time of intact, and was suitable for printing between recording heads at the time of wearing to a recording head, and was stabilized can be made to perform.

[0054] Since adhesion with a valve element is furthermore securable with the elasticity of a film valve seat, are concerned and there is nothing to rocking of the ink of the ink room resulting from migration of carriage, and a valve function can be made to be able to discover certainly, it can be concerned with migration of carriage, differential pressure with a recording head can be maintained uniformly that there is nothing, and improvement in a quality of printed character can be aimed at.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] According to this, since it becomes unnecessary to hold a porous body in a cartridge, it becomes possible to enlarge substantial ink capacity of a tank, but generally an AMBURERA check valve has the big problem of the amount of offset being too large, and causing fluctuation to the ink amount of supply and causing deterioration of a quality of printed character for adjusting supply of the ink to a recording head to a precision.

[0007] After the AMBURERA check valve has closed the valve on the other hand Since an ink reservoir and a recording head are intercepted completely, the ink of a cavity by change of

environmental temperature 2 thru/or when cubical expansion is carried out 5% In the condition that the pressure of a cavity rises and damage the seal of an end connection with a recording head, and ink is revealed and the recording head is equipped This pressure acts on a recording head as it is, it becomes impossible to maintain the negative pressure between a recording head and an ink tank, and there is a problem that leakage of ink arises from a recording head.

[0008] Furthermore, in the differential pressure of dozens mmAq extent which should be maintained in order to perform stable ink supply to a recording head, since an AMBURERA check valve has the weak clausilium force, it opens following rocking of the ink by migration of carriage, and has the problem that stable printing is impossible.

[0009] The place which this invention is made in view of such a problem, and is made into the purpose Ink can be certainly supplied for the negative pressure which was suitable for printing between recording heads, without having certainly followed the minute differential pressure between recording heads, and being influenced by rocking of the ink by migration of carriage to maintenance \*\*\*\*\*. It is offering the ink cartridge which can furthermore prevent leakage of the ink from the ink feed hopper by the temperature change, and leakage of the ink from a recording head.

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## MEANS

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[Means for Solving the Problem] While dividing so that an ink room might be formed in the upper part and an ink supply room might be formed in the lower part by the film valve seat which consists the container which equipped the base with the ink feed hopper of an elastic thin film which equipped the core with the through-hole in this invention in order to solve such a problem, said film valve seat prepared the valve element which contacts by the differential pressure of said ink room and said ink supply room in the location which counters said through-hole.

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## OPERATION

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[Function] When ink is supplied to a recording head and the pressure of an ink supply room rises by a temperature rise etc., without a film valve seat's opening the passage from an ink room to an ink supply room in response to differential pressure corresponding to consumption of slight ink in a large area, and making too much negative pressure act on a recording head, a film valve seat follows, a part for a pressure buildup is missed in an ink room, and leakage of the ink from a recording head is prevented. Moreover, it sticks with a valve element with own elasticity of a film valve seat, and closing motion of the valve portion material by rocking of carriage is prevented certainly.

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EXAMPLE

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[Example] Then, based on the example illustrating the detail of this invention, it explains below. Drawing 1 shows one example of this invention, the sign 1 in drawing is the container which constitutes an ink cartridge body, and the ink feed hopper 2 in which the ink supply needle of a recording head is inserted is formed in base 1a, and the space in a container is divided into the ink room 4 and the ink supply room 5 by the film valve seat 3 mentioned later.

[0013] 3 is the above-mentioned film valve seat, it drills a through-hole 6 in the center, is constituted by elastic membrane equipped with endurance to ink, such as rubber membrane and macromolecule elastomer film, and is stretched by the level difference section 7 formed in the lower part of a container 1.

[0014] 8 is constituted so that it may be inserted in the through-hole 10 which is a valve element and is prepared in the valve assembly 9 movable up and down, and it may have the size which can secure the gap which is extent which can make it flow down ink and die length may become long a little rather than the thickness of the valve assembly 9, and the film valve seat 3 is made for the valve element supporter material 11 later mentioned so that the lower part may always close the through-hole 6 of the film valve seat 3 to \*\*\*\* it. The ink passage 15 which leads ink to the valve assembly 9 is formed.

[0015] It is the above-mentioned valve element supporter material, and while it is stretched by the front face of the valve assembly 9 and the film valve seat 3 is made to always \*\*\*\* a valve element 8, 11 restricts that a valve element 8 descends rather than a fixed location, and it is constituted so that the crowning of a valve element 8 may be held by the through-hole, while drilling a through-hole 12 in the elastic membrane which consists of an ingredient equivalent to the film valve seat 3.

[0016] The closure of the container 1 is carried out by the covering device material 13 equipped with the atmospheric-air free passage hole 14 in the top face. The rill 31 which constitutes the capillary which connects these with the crevice 30 which encloses this free passage hole 14, and the free passage opening 32 which separates a fixed distance and is located from this crevice 30 is formed in the ink room side of the covering device material 13. When the covering device material 13 is located in the top face of these crevices 30 and a slot 31 up, the flexible film 33 which slacked extent which separates from a through-hole is stretched.

[0017] These film valve seat 3, the valve element base material 11, and a valve element 8 are preferably attached and constituted by the valve assembly 9 at one, carry out invagination to the level difference section 7 of a container 1, and are included in the container 1.

[0018] In this example, if a container 1 is leaned and the ink of the ink room 4 contacts the covering device material 13, in order that the flexible film 33 may contact heights 14a around a through-hole 14 in response to the pressure of ink, the closure of the through-hole 14 is carried out, and leakage \*\*\*\* of the ink from the atmospheric-air free passage hole 14 is prevented.

[0019] If the ink feed hopper 2 is inserted in the ink supply needle of a recording head carried in carriage, the ink supply room 5 and a recording head will be connected. In this condition, since the flexible film 33 of the covering device material 13 hangs down with gravity and a through-hole 14 is opened wide, the ink room 4 is open for free passage with atmospheric air through a crevice 30, a slot 31, and the free passage hole 32.

[0020] If printing is performed and an ink droplet carries out the regurgitation from a recording head in this condition, the ink of the ink supply room 5 will flow into a recording head from the

ink feed hopper 2, and the pressure of the ink supply room 5 will decline gradually. The film valve seat 3 descends corresponding to the pressure drop of the ink supply room 5, expanding in the shape of [ which has a radius R with the elasticity in response to the pressure from the ink room 4 ] the spherical surface. At this time, it prevents that prevent the influx of the ink from the ink room 4 to the ink supply room 5, and the pressure of the ink supply room 5 rises too much, preventing that the pressure of the ink supply room 5 declines too much, since a valve element 8 follows the film valve seat 3 ( drawing 2 (\*\*)). Thereby, the pressure of a recording head is maintained by the fixed negative pressure condition to the ink room 4.

[0021] If consumption of the ink in a recording head furthermore progresses and the film valve seat 3 descends much more, since it will be prevented that a valve element 8 descends below in a fixed location by the valve element supporter material 11, a valve element 8 separates from the film valve seat 3 very only ( drawing 2 (\*\*)). Thereby, the ink of the ink room 4 flows into the ink supply room 5 from a through-hole 6 via the narrow gap formed between the valve element 8 and the film valve seat 3.

[0022] If the pressure of the ink supply room 5 rises a little by the inflow of ink, the film valve seat 3 will move to a valve element 8 side with own elasticity, it will \*\*\*\* to a valve element 8, and a through-hole 6 will be closed by the inferior surface of tongue of a valve element 8. Thereby, the influx of the ink of ink supply room 5 HE stops from the ink room 4. Consequently, there is no \*\*\*\* in the amount of the ink of the ink room 3, and the pressure of the ink feed hopper 2 will be maintained uniformly.

[0023] Hereafter, whenever the pressure of the ink supply room 6 declines a little, the film valve seat 3 expands caudad a little, a gap is formed between valve elements 8, and the ink of the ink room 3 is made to flow into the ink supply room 5 from this gap. Thus, since the film valve seat 3 formed by elastic membrane attaches and detaches to a valve element 8 to compensate for consumption of ink, if the elasticity of the film valve seat 3 is set as suitable magnitude, it not only can make very small the pressure at the ink supply initiation time and the differential pressure at the ink supply interruption time, i.e., offset, but it will become possible to discharge all the ink of the ink room 4 to a recording head.

[0024] On the other hand, although the pressure of the ink supply room 5 rises in the condition that printing is interrupted when environmental temperature rises, it moves to the ink room 4 side where the film valve seat 3 is wide opened by atmospheric air following this pressure. Leakage of the ink from the recording head which it is prevented that the pressure of the ink supply room 5 rises, it is concerned with a temperature rise by this, and the negative pressure [ be / nothing ] optimal between recording heads is maintained, therefore originates in a pressure buildup will be prevented.

[0025] Drawing 3 is constituted from rubber membrane from which it is 0.04mm in thickness as a film valve seat 3, and the field in which it is possible, an effective diameter, i.e., elastic deformation, serves as a diameter of 20mm. Moreover, it is what shows the water head value change of the ink cartridge of this invention which set up the minimum location of a valve element 8 so that the radius R of the spherical surface in just before outflow (i.e., the critical state with a valve element 8) ( drawing 2 (\*\*)) might be set to 26mm. Also when a lot of ink of 5g/m is supplied, the increment in a water head value is small, and it turns out that ink can be supplied smoothly, without making too much negative pressure act on a recording head also to a lot of ink consumption by the recording head.

[0026] on the other hand, in closing the ink feed hopper 2 with a seal 16 in a production process, making negative pressure act on the ink room 4 and eliminating the air in a cartridge Since the

pressure of the ink room 4 declines rather than the ink supply room 5, and a valve element 8 resists the elastic force of the valve element supporter material 11, moves to an ink room side and forms space between the film valve seat 3 and a valve element 8 as shown in drawing 2 (Ha). There is no \*\*\*\* in existence of the film valve seat 3 and a valve element 8, and the air of the whole cartridge can be eliminated and it becomes possible to fill up the whole cartridge with ink including the ink supply room 5.

[0027] When drawing 4 shows other examples of a valve element 8 and the inferior surface of tongue of a valve element 8 contacts the film valve seat 3 in this example, the plate-like piece 35 of positioning which contacts the top face of the valve assembly 9 is formed.

[0028] According to this example, in the condition that the valve element 8 is in contact with the film valve seat 3, the piece 35 of positioning contacts the top face of the valve assembly 9, and since a valve element 3 is supported by the valve assembly 9 and a perpendicular posture is maintained as much as possible, the through-hole 6 of the film valve seat 3 can be certainly closed also to vibration by movement of carriage etc.

[0029] The minimum location is prescribed by when the piece 36 of positioning which drawing 5 shows other examples of this invention, and the sign 20 in drawing is a valve element, and was inserted in valve element hold room 9a formed in the valve assembly 9 in the condition of always having been caudad oppressed with the spring 21, and was formed in heights 9b of the lower part of valve element hold room 9a at the valve element 20 contacts. In addition, the signs 22 and 23 in drawing show the through-hole which connects the ink room 4 and the ink supply room 5, respectively.

[0030] In this example, the film valve seat 3 descends corresponding to the pressure drop of the ink supply room 5, expanding in the shape of [ which has a radius R with that elasticity in response to the pressure from the ink room 4 ] the spherical surface. At this time, the influx of the ink from the ink room 4 to the ink supply room 5 is prevented, preventing that the pressure of the ink supply room 5 declines too much, since a valve element 20 follows the film valve seat 3 with the elasticity of a spring 21 and the piece 36 of positioning is held in contact with heights 9b at a posture with a perpendicular valve element 20 ( drawing 6  $R > 6$  (\*\*)). Thereby, there is no \*\*\*\* in rocking by migration of carriage, and since the film valve seat 3 contacts a valve element 20, the ink pressure of a recording head is maintained by the fixed negative pressure condition to the ink room 4.

[0031] If consumption of the ink in a recording head progresses and the film valve seat 3 descends much more, since it will be prevented that a valve element 20 descends below in a fixed location by projection 9b of valve element hold room 9a, a valve element 8 separates from the film valve seat 3 very only ( drawing 6 (\*\*)). Thereby, the ink of the ink room 4 flows into the ink supply room 5 from a through-hole 6 via the narrow gap formed between the valve element 8 and the film valve seat 3.

[0032] If the pressure of the ink supply room 5 rises a little by the inflow of ink, the film valve seat 3 will move to a valve element 20 side with own elasticity, it will \*\*\*\* to a valve element 20, and a through-hole 6 will be closed by the inferior surface of tongue of a valve element 8. Thereby, the influx of the ink of ink supply room 5 HE stops from the ink room 4. Consequently, there is no \*\*\*\* in the amount of the ink of the ink room 3, and the pressure of the ink feed hopper 2 will be maintained uniformly.

[0033] on the other hand, in closing the ink feed hopper 2 with a seal 16 in a production process, making negative pressure act on the ink room 4 and eliminating the air in a cartridge Since the pressure of the ink room 4 declines rather than the ink supply room 5, and a valve element 8



resists a spring 21, moves to an ink room side and forms a gap between the film valve seat 3 and a valve element 20 as shown in drawing 6 (Ha) There is no \*\*\*\* in existence of the film valve seat 3 and a valve element 20, and the air of the whole cartridge can be eliminated and it becomes possible to fill up the whole cartridge with ink including an ink supply room.

[0034] In addition, although he is trying to incorporate the elastic member which makes a valve element 20 contact the film valve seat 3 into the valve assembly 9, as shown in drawing 7, a valve element 37 is formed in a bamboo hat type, capping 37a is operated as the piece of positioning, and a stopper, and you may make it oppress top-most vertices to the film valve seat 3 side with a spring 38 in an above-mentioned example.

[0035] Since a valve element 37 and a spring 38 can be attached from the exterior of the valve assembly 9 according to this example, simplification of assembly operation can be attained.

[0036] In addition, although he is trying to prepare a spring in a valve element up in an above-mentioned example As shown in drawing 8, the diaphragm 41 equipped with through-hole 41a separates a container 40 into the ink room 42 and the ink supply room 43. In the ink supply room 43 The film valve seat 44, The valve element 46 which consists of supporter 46b which is perpendicularly prolonged from spherical-surface 46a which closes the through-hole 45 of the film valve seat 44 on the inferior surface of tongue, and spherical-surface 46a, and penetrates the through-hole 45 of the film valve seat 44 is held. Even if it supports supporter 46b through the spring 47 always oppressed caudad, it is clear to do the same operation so. In addition, the sign 48 in drawing fits in with the lower limit of supporter 46b, and 49 shows [ a valve element 46 ] an ink feed hopper to a perpendicular posture for a positioning guide hole again.

[0037] According to this example, since it is concerned with the buoyancy in ink in order to lengthen that lower part caudad with a spring 47, and a posture is stabilized that there is nothing, are concerned, and there is no valve element 46 in rocking by migration of carriage, and it can supply ink to a recording head at stability.

[0038] Drawing 9 shows other examples of this invention, it consists of film of the porous body of the elasticity nature of extent which the sign 50 in drawing is the oil-level stabilization film, and can follow migration of the film valve seat 3, and grid-like film, the through-hole 51 which fits into a valve element 8 is formed in the field which counters a valve element 8, and a perimeter is fixed to an assembly 9, and the center section is fixed to the valve element 8.

[0039] In this example, if the pressure of the ink supply room 5 declines by consumption of consumption of ink, the film valve seat 3 separates from a valve element 8, and the ink of the ink room 4 will pass the oil-level stabilization film 50, and will flow into the ink supply room 5.

[0040] Although it will originate in migration of carriage and ink will rock violently by about eight valve element if consumption of ink furthermore progresses and the oil level of the ink room 4 falls to about nine assembly, after pressure fluctuation is suppressed as much as possible with the oil-level stabilization film 50, the through-hole 6 of the film valve seat 3 will be passed, and ink \*\* of a recording head is kept constant with respect to reduction of the amount of ink of the ink room 4 that there is nothing.

[0041] In addition, although he is trying to make a valve element \*\*\*\* to the film valve seat 3 using an elastic means in an above-mentioned example, if the elastic force of film valve seat 3 self is used positively, the elastic member made to \*\*\*\* a valve element to the film valve seat 3 can be made unnecessary. Drawing 10 shows one example which made unnecessary the elastic member which oppresses a valve element to a film valve seat, it is a film valve seat, and a through-hole 25 is formed in the valve element 28 mentioned later and the field which counters, and the sign 24 in drawing is being fixed with the valve assembly 27 in the perimeter. 28 is a

valve element, and it is being fixed to migration impossible so that it may become a posture perpendicular to the valve assembly 27. In addition, the sign 29 in drawing shows the through-hole which connects the ink room 4 and the ink supply room 5.

[0042] In this example, when the differential pressure of the ink room 4 and the ink supply room 5 is below a predetermined value, since the film valve seat 24 \*\*\*\* a through-hole 25 to a valve element 28 with own elasticity, the flow of the ink of ink supply room 5 HE stops from the ink room 4.

[0043] On the other hand, when a through-hole 25 will separate from a valve element 28, ink will flow into the ink supply room 5 from the ink room 4, supply of ink will progress and the pressure of the ink supply room 5 will rise in order to descend, while the film valve seat 24 expands in the shape of the spherical surface if the pressure of the ink supply room 5 declines, the film valve seat 24 overcomes differential pressure, \*\*\*\* to a valve element 28, and stops the outflow of ink.

[0044] By the way, if air infiltrates into a recording head, in order for the pressure for making an ink droplet breathe out to be absorbed by the air bubbles which originated in air and were generated in the passage of a recording head and to cause poor printing, it is necessary to prevent air absorption of the recording head at the time of ink termination of an ink cartridge.

[0045] Drawing 11 shows one example of the ink cartridge which prevented permeation of the air to the recording head at the time of ink termination of such a recording head, and forms in the connection field of the ink feed hopper 52 and the ink supply room 53 the conic valve seat 54 which the upper part extends, while holding the spherical float valve 55 which comes floating here by buoyancy, the valve guard plates 56, such as a network which can penetrate ink, are formed, and an electric shielding valve constitutes the upper part. In addition, the sign 57 in drawing shows the film valve seat which controls the inflow of the ink from an ink room in contact with a valve element 58.

[0046] This example sets, in the condition that the recording head is equipped with the ink cartridge, it will be in the condition that the float valve 55 stuck to the valve guard plate 56 by buoyancy, the ink feed hopper 52 is opened wide, and supply of the ink to a recording head is performed.

[0047] On the other hand, if consumption of the ink of a cartridge progresses and the water level of ink falls to about 52 ink feed hopper, a float valve 55 will lose the buoyancy in ink, and will contact a valve seat 54 (condition shown by the dotted line among drawing). Therefore, though printing progresses further, since the closure of the ink feed hopper 52 is carried out, permeation of the air to a recording head is prevented and generating of a printing failure can be prevented beforehand.

[0048] Moreover, although it does not insert until it is all consumed in the ink of an ink room if a recording head is usually equipped with an ink cartridge, it may be extracted from a recording head by the actuation which was still mistaken. Thus, once the cartridge with which it was equipped is extracted from a recording head, the ink feed hopper 2 will be wide opened by atmospheric air, air will trespass upon an ink supply room or an ink room, and it will have a bad influence on record actuation.

[0049] Drawing 12 shows the example for preventing above-mentioned un-arranging resulting from attachment and detachment of an ink cartridge, the sign 60 in drawing is the valve element which can be expanded and contracted and which was prepared in the ink feed hopper 61, and the ink supply needle fitting hole 62 with which the ink supply needle 70 fits into the lower part is formed. Moreover, when it moves to an upper limit location, the through-hole 64 which

connects the ink supply room 63 and the ink supply needle fitting hole 62 is drilled.

[0050] In this example, as shown in drawing 12 (b), a valve element 60 \*\*\*\* with elasticity to pars-basilaris-ossis-occipitalis 63a of the ink supply room 63, and the outflow of the ink from the ink supply room 63 is always prevented certainly.

[0051] If the ink supply needle 70 is inserted in the fitting hole 62, a valve element 60 will develop even in an upper limit location, and it will separate from base 63a of the ink supply room 63, and the free passage hole 64 will be exposed to the ink supply room 63 (this drawing (\*\*)). The ink supply room 63 and ink passage 70a of the ink supply needle 70 will be connected through the free passage holes 64 and 70b by this, the ink of the ink supply room 63 will flow into the ink supply needle 70, and ink will be supplied to a recording head.

[0052] If the ink cartridge with which the recording head was equipped is removed, since a valve element 60 will move caudad and will intercept the ink supply room 63 and the ink feed hopper 61 (this drawing (\*\*)), the outflow of the ink from the ink supply room 63 and permeation of the air to the ink supply room 63 will be prevented.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing one example of this invention.

[Drawing 2] Drawing (\*\*) and (\*\*) are drawings showing actuation with the film valve seat in the condition that the recording head was equipped, and a valve element, respectively, and this drawing (Ha) is drawing showing the condition of the valve element in the case of filling up an ink cartridge with ink.

[Drawing 3] It is the diagram showing the relation between the discharge of the ink of the ink cartridge of this invention, and a water head value.

[Drawing 4] It is drawing in which expanding near the ink supply room and showing other examples of this invention.

[Drawing 5] It is the sectional view showing other examples of this invention.

[Drawing 6] Drawing (\*\*) and (\*\*) are drawings showing the film valve seat in the condition that the recording head was equipped, and actuation of a valve element, respectively, and this drawing (Ha) is drawing showing the condition of the valve element in the case of filling up an ink cartridge with ink.

[Drawing 7] It is drawing in which expanding near the ink supply room and showing other examples of this invention.

[Drawing 8] It is drawing in which expanding near the ink supply room and showing other examples of this invention.

[Drawing 9] It is drawing in which expanding near the ink supply room and showing other examples of this invention.

[Drawing 10] It is drawing in which expanding near the ink supply room and showing other examples of this invention.

[Drawing 11] It is drawing showing the example of an ink feed hopper.

[Drawing 12] Drawing (b) and (b) are drawings showing other examples of an ink feed hopper, respectively where a recording head is equipped, the condition of not being equipped by the recording head, and.

[Description of Notations]

1 Container  
2 Ink Feed Hopper  
3 Film Valve Seat  
4 Ink Room  
5 Ink Supply Room  
6 Through-hole  
7 Level Difference Section  
8 Valve Element  
9 Valve Assembly  
25 Elasticity Porous Body Film

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CORRECTION OR AMENDMENT

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[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] The name of invention

[Method of Amendment] Modification

[Proposed Amendment]

[Title of the Invention] Ink cartridge

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] In the ink cartridge equipped with the ink hold field which is open for free passage to the ink feed hopper to which the insert and remove of the ink supply needle which is removable

on the carriage equipped with the ink jet recording head, and is open for free passage to said recording head are carried out, and said ink feed hopper The closure member which has a through-hole for ink circulation at the core, counters said through-hole of the elastic body which has been arranged between said ink hold fields and said ink feed hoppers, and in which elastic deformation is possible, and said elastic body, is arranged, and attaches and detaches to said elastic body, and the ink cartridge which it has.

[Claim 2] The ink cartridge equipped with the ink hold field which is open for free passage to the ink feed hopper to which the insert and remove of the ink supply needle which is characterized by providing the following, and which is removable on the carriage equipped with the ink jet recording head, and is open for free passage to said recording head are carried out, and said ink feed hopper The elastic body which has a through-hole for ink circulation at the core, and has been arranged between said ink hold fields and said ink feed hoppers and in which elastic deformation is possible The closure member which counters said through-hole of said elastic body, is arranged, and attaches and detaches to said elastic body The member which pinches said ink cartridge in the container to constitute, and fixes the perimeter of said elastic body

[Claim 3] The ink cartridge according to claim 2 by which said closure member is formed in claim 2 currently formed in said member to fix.

[Claim 4] Claim 1 which carries out elastic deformation so that said elastic body may separate from said closure member, when ink is consumed by said recording head and the pressure by the side of said ink feed hopper declines, or an ink cartridge according to claim 2.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0009

[Method of Amendment] Modification

[Proposed Amendment]

[0009] The place which this invention is made in view of such a problem, and is made into the purpose is offering the ink cartridge which maintains the negative pressure which was suitable for printing between recording heads, and can supply ink to a recording head certainly, without certainly following the minute differential pressure between recording heads, and being influenced by rocking of the ink by migration of carriage.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0010

[Method of Amendment] Modification

[Proposed Amendment]

[0010]

[Means for Solving the Problem] In order to solve such a problem invention of claim 1 In the ink cartridge equipped with the ink hold field which is open for free passage to the ink feed hopper to which the insert and remove of the ink supply needle which is removable on the carriage equipped with the ink jet recording head, and is open for free passage to said recording head are carried out, and said ink feed hopper It has a through-hole for ink circulation at the core, and said through-hole of the elastic body which has been arranged between said ink hold fields and said ink feed hoppers and in which elastic deformation is possible, and said elastic body is countered, and it is arranged, and consists of closure members which attach and detach to said elastic body. Invention of claim 2 is removable on the carriage equipped with the ink jet recording head. In the ink cartridge equipped with the ink hold field which is open for free passage to the ink feed

hopper to which the insert and remove of the ink supply needle which is open for free passage to said recording head are carried out, and said ink feed hopper The elastic body which has a through-hole for ink circulation at the core, and has been arranged between said ink hold fields and said ink feed hoppers and in which elastic deformation is possible, Said through-hole of said elastic body is countered, and it is arranged, and consists of a closure member which attaches and detaches to said elastic body, and a member which pinches said ink cartridge in the container to constitute, and fixes the perimeter of said elastic body.

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0011

[Method of Amendment] Modification

[Proposed Amendment]

[0011]

[Function] According to invention of claim 1, in response to differential pressure, a through-hole is wide opened in a large area, and an elastic body maintains predetermined negative pressure and supplies the ink of an ink hold field to a recording head. According to invention of claim 2, an elastic body is certainly [ simply and ] incorporable into an ink cartridge with the activity of carrying out the laminating of an elastic body and the member to fix to the container which constitutes an ink cartridge in addition to the above-mentioned operation.

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0053

[Method of Amendment] Modification

[Proposed Amendment]

[0053]

[Effect of the Invention] As mentioned above, as explained, according to invention of claim 1, in response to differential pressure, a through-hole is wide opened in a large area, an elastic body can maintain predetermined negative pressure, and can supply the ink of an ink hold field to a recording head, it can be concerned with migration of carriage, and improvement in a quality of printed character can be aimed at that there is nothing. According to invention of claim 2, an elastic body can open a through-hole wide in response to differential pressure in a large area, and can build simply and certainly into an ink cartridge the elastic body which maintained predetermined negative pressure, it not only can supply the ink of an ink hold field to a recording head, but was easy to transform it by slight differential pressure, and was constituted.

[Procedure amendment 7]

[Document to be Amended] Specification

[Item(s) to be Amended] 0054

[Method of Amendment] Deletion

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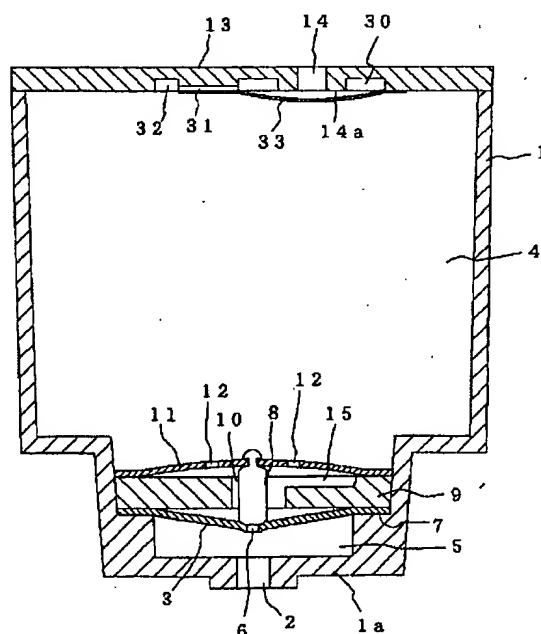
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(54) 【発明の名称】 インクジェットプリンタ用インクカートリッジ

(57) 【要約】

【課題】 多孔質体を使用すること無く、インク室のインクを安定かつ確実に記録ヘッドに供給すること。

【解決手段】 底面にインク供給口2を備えた容器1を、中心部に通孔6を備えた弾性薄膜からなる膜弁座3により上部にインク室4を、また下部にインク供給室5を形成するように分割するとともに、通孔6に対向する位置に、膜弁座3がインク室4とインク供給室5との圧力差により当接する弁体8を設ける。膜弁座3が広い面積で差圧を受けて僅かなインクの消費に対応してインク室4からインク供給室5への流路を開いて記録ヘッドに過度な負圧を作用させることなくインクを記録ヘッドに排出し、またインク供給室の圧力上昇分を膜弁座の変形によりインク室に吸収する。



1

## 【特許請求の範囲】

【請求項1】 底面にインク供給口を備えた容器を、中心部に通孔を備えた弾性薄膜からなる膜弁座により上部にインク室を、また下部にインク供給室を形成するように分割するとともに、前記通孔に対向する位置に前記膜弁座が前記インク室と前記インク供給室との圧力差により当接する弁体を設けてなるインクジェットプリンタ用インクカートリッジ。

【請求項2】 前記インク供給室の圧力が前記インク室の圧力よりも所定値以上低下した場合に、前記膜弁座が前記インク供給室側に凸となるように球状に膨張する請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項3】 前記弁体は、弾性付与手段により一定の下限位置まで常時膜弁座に弾圧されている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項4】 前記弾性付与手段が弾性膜である請求項3のインクジェットプリンタ用インクカートリッジ。

【請求項5】 前記弾性付与手段がバネである請求項3のインクジェットプリンタ用インクカートリッジ。

【請求項6】 前記弁体が前記膜弁座に対して垂直となるように位置決め片が設けられている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項7】 前記弁体を貫通させて前記膜弁座に追従するようにインク透過性の膜からなる液面安定化膜が設けられている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項8】 前記弾性薄膜がゴム膜、または高分子エラストマー膜である請求項1、3のインクジェットプリンタ用インクカートリッジ。

【請求項9】 前記弁体が弁組立体に固定されている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項10】 前記インク室の上部に大気連通孔が設けられ、常時は前記連通孔から離れ、またインクに当接した場合に前記大気連通孔を封止する可撓性膜が前記インク室側に張設され、前記インク室がキャピラリを介して前記大気連通孔に接続する請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項11】 前記キャピラリが、前記容器の蓋体に形成された細溝と、これの表面を前記可撓性膜で封止して構成されている請求項10のインクジェットプリンタ用インクカートリッジ。

【請求項12】 前記インク供給口に、前記インク供給室のインクが少なくなったときに閉弁する遮蔽弁が設けられている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項13】 前記遮蔽弁が、インク供給室側に拡開する円錐状の弁座と、球状の浮き弁と、前記浮き弁を前記弁座の空間に捕捉する弁押え板とから構成されている

2

請求項12のインクジェットプリンタ用インクカートリッジ。

【請求項14】 前記インク供給口に、記録ヘッドに装着されたとき開弁し、また記録ヘッドから取り外されたとき閉弁する遮蔽弁が設けられている請求項1のインクジェットプリンタ用インクカートリッジ。

【請求項15】 前記遮断弁が、インク供給針の挿入により前記インク供給室側に移動する弁体を前記インク供給口に挿入して構成されている請求項14のインクジェットプリンタ用インクカートリッジ。

## 【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、インクジェット式記録ヘッドを搭載するキャリッジに装着するのに適したインクカートリッジに関する。

【0002】

【従来の技術】インクジェットプリンタは、共通のインク室とノズル開口とに連通する圧力発生室に圧力を印加してノズル開口からインク滴を吐出させるインクジェット式記録ヘッドをキャリッジと、記録ヘッドにインクを供給するインクカートリッジを搭載し、キャリッジを往復動させながら印刷データに一致させてインク滴を記録用紙に吐出させるように構成されている。

【0003】ところで記録ヘッドのノズル開口は、インクカートリッジのインク液面よりも低い箇所に位置しているため、ノズル開口には水頭圧が作用するため、通常インクカートリッジ内に多孔質体を収容し、多孔質体による表面張力によりインクカートリッジの圧力がノズル開口よりも若干低くなるように構成して、ノズル開口からのインクのしみ出しを防止する対策がとられている。

【0004】しかしながら、インクの消費が進んで多孔質体に吸収されているインクの量が少なくなると、多孔質体の表面張力が大きくなって記録ヘッドへのインクの供給が滞りやすくなり、カートリッジ内のインクを完全に消費できないという問題がある。また、多孔質体の実質的な体積の分だけ、カートリッジに収容できるインクが少なくなるため、インクカートリッジが大型化するという問題がある。

【0005】このような問題を解決するため、例えば米国特許第4,677,447号明細書（特開昭62-231759号公報）に示されたようにインクタンクの下部に通孔を備えた壁によりインク溜めと空洞とに分離し、この通孔にアンブレラチェックバルブを移動可能に設けて、記録ヘッドのインク圧が低下した時点で、バルブを開弁させてタンク溜めのインクを空洞に排出させて記録ヘッドに供給するように構成したインクジェット記録ヘッド用のインクカートリッジが提案されている。

【0006】

【発明が解決しようとする課題】これによれば、カートリッジ内に多孔質体を収容する必要がなくなるため、タ



3

ンクの実質的インク収容量を大きくすることが可能となるが、一般的にアンブレラチェックバルブは、記録ヘッドへのインクの供給を精密に調整するにはそのオフセット量が大き過ぎ、インク供給量に変動を来して印字品質の低下を招くという大きな問題がある。

【0007】一方ではアンブレラチェックバルブが閉弁した状態では、インク溜部と記録ヘッドとが完全に遮断されるため、環境温度の変化で空洞のインクが2乃至5%体積膨張した場合には、空洞の圧力が上昇して記録ヘッドとの接続口のシールを破損してインクが漏洩したり、また記録ヘッドに装着されている状態では、この圧力がそのまま記録ヘッドに作用して記録ヘッドとインクタンクとの間での負圧を維持できなくなって記録ヘッドからインクの漏洩が生じるという問題がある。

【0008】さらには、アンブレラチェックバルブは、記録ヘッドへの安定なインク供給を行うために維持すべき数十mmAq程度の圧力差では閉弁力が弱い、キャリッジの移動によるインクの揺動に応動して開弁してしまい、安定な印字が不可能であるという問題がある。

【0009】本発明はこのような問題に鑑みてなされたものであって、その目的とするところは、記録ヘッドとの間の微小な差圧に確実に応動し、かつキャリッジの移動によるインクの揺動に左右されることなく記録ヘッドとの間で印字に適した負圧を維持して記録ヘッドに確実にインクを供給でき、さらには温度変化によるインク供給口からのインクの漏洩や、記録ヘッドからのインクの漏洩を防止することができるインクカートリッジを提供することである。

【0010】

【課題を解決するための手段】このような問題を解消するために本発明においては、底面にインク供給口を備えた容器を、中心部に通孔を備えた弾性薄膜からなる膜弁座により上部にインク室を、また下部にインク供給室を形成するように分割するとともに、前記通孔に対向する位置に前記膜弁座が前記インク室と前記インク供給室との圧力差により当接する弁体を設けるようにした。

【0011】

【作用】膜弁座が広い面積で差圧を受けて僅かなインクの消費に対応してインク室からインク供給室への流路を開いて記録ヘッドに過度な負圧を作用させることなく記録ヘッドにインクを供給し、また温度上昇などによりインク供給室の圧力が上昇した場合には膜弁座が応動して圧力上昇分をインク室に逃がして記録ヘッドからのインクの漏洩を防止する。また、膜弁座自身の弾性により弁体と密着して、キャリッジの揺動による弁部材の開閉を確実に防止する。

【0012】

【実施例】そこで、以下に本発明の詳細を図示した実施例に基づいて説明する。図1は、本発明の一実施例を示すものであって、図中符号1は、インクカートリッジ本

4

体を構成する容器で、底面1aには記録ヘッドのインク供給針が挿入されるインク供給口2が形成され、また容器内の空間は後述する膜弁座3によりインク室4とインク供給室5に分割されている。

【0013】3は前述の膜弁座で、インクに対して耐久性を備えたゴム膜や高分子エラストマー膜等の弾性膜に、中央に通孔6を穿設して構成され、容器1の下部に形成された段差部7に張設されている。

【0014】8は、弁体で、弁組立体9に設けられている通孔10に上下に移動可能に挿入されており、インクを流下させることができる程度の間隙を確保できる太さを備え、かつ長さが弁組立体9の厚さよりも若干長くなるように構成され、常時は下部が膜弁座3の通孔6を封止するように後述する弁体支持部材11により膜弁座3に弾接させられている。弁組立体9にはインクを導くインク流路15が形成されている。

【0015】11は、前述の弁体支持部材で、弁組立体9の表面には張設され、常時弁体8を膜弁座3に弾接させる一方、弁体8が一定位置よりも降下するのを制限するもので、膜弁座3と同等の材料からなる弾性膜に通孔12を穿設するとともに、弁体8の頂部を通孔により保持するように構成されている。

【0016】容器1は、その上面を大気連通孔14を備えた蓋部材13により封止されている。蓋部材13のインク室側にはこの連通孔14を取り囲む凹部30と、この凹部30から一定の距離を隔てて位置する連通口32と、これらを接続するキャピラリを構成する細溝31が形成されている。これら凹部30及び溝31の上面には、蓋部材13が上方に位置する場合には通孔から離れる程度にたるませた可撓性膜33が張設されている。

【0017】これら膜弁座3、弁体支持部材11、及び弁体8は、好ましくは弁組立体9に一体に組み付けて構成され、容器1の段差部7に陥入させて容器1に組み込まれている。

【0018】この実施例において、容器1が傾けられてインク室4のインクが蓋部材13に接触すると、可撓性膜33がインクの圧力を受けて通孔14の周囲の凸部14aに接触するため、通孔14が封止され、大気連通孔14からのインクの漏れ出しが防止される。

【0019】インク供給口2を、キャリッジの搭載されている記録ヘッドのインク供給針に挿通すると、インク供給室5と記録ヘッドとが接続される。この状態では、蓋部材13の可撓性膜33が重力により垂れ下がって通孔14が開放されるから、凹部30、溝31、及び連通孔32を介してインク室4が大気と連通する。

【0020】この状態で、印刷が実行されて記録ヘッドからインク滴が吐出すると、インク供給室5のインクがインク供給口2から記録ヘッドに流れ込み、インク供給室5の圧力が徐々に低下する。インク供給室5の圧力低下に対応して膜弁座3は、インク室4からの圧力を受け

てその弾性により半径Rを持つ球面状に膨張しながら降下する。この時点では弁体8が膜弁座3に追従するため(図2(イ))、インク供給室5の圧力が過度に低下するのを防止しつつ、インク室4からインク供給室5へのインクの流れ込みを阻止して、インク供給室5の圧力が過度に上昇するのを防止する。これにより、記録ヘッドの圧力がインク室4に対して一定の負圧状態に維持される。

【0021】さらに記録ヘッドでのインクの消費が進んで膜弁座3が一段と降下すると、弁体8が弁体支持部材11により一定位置以下に降下するのを阻止されるから、弁体8が膜弁座3から極わずかに離れる(図2(ロ))。これにより、インク室4のインクが弁体8と膜弁座3との間に形成された狭い間隙を経由して通孔6からインク供給室5に流れ込む。

【0022】インクの流入によりインク供給室5の圧力が若干上昇すると、膜弁座3が自身の弾性により弁体8側に移動して弁体8に弾接し、通孔6が弁体8の下面で塞がれる。これによりインク室4からインク供給室5へのインクの流れ込みが停止する。この結果、インク室3のインクの量に関りなく、インク供給口2の圧力が一定に維持されることになる。

【0023】以下、インク供給室6の圧力が若干低下する度に膜弁座3が若干下方に膨張して弁体8との間に間隙を形成し、この間隙からインク室3のインクをインク供給室5に流れ込ませる。このように弾性膜で形成された膜弁座3がインクの消費に合わせて弁体8に接離するため、膜弁座3の弾性を適切な大きさに設定すると、インク供給開始時点の圧力とインク供給停止時点の圧力差、つまりオフセットを極めて小さくすることができるばかりでなく、インク室4のインクを全て記録ヘッドに排出することが可能となる。

【0024】一方、印刷が中断している状態で、環境温度が上昇した場合には、インク供給室5の圧力が上昇するが、膜弁座3がこの圧力に応動して大気に開放されているインク室4側に移動する。これにより、インク供給室5の圧力が上昇するのが防止され、温度上昇に関わりなく記録ヘッドとの間で最適な負圧が維持され、したがって圧力上昇に起因する記録ヘッドからのインクの漏洩が防止されることになる。

【0025】図3は、膜弁座3として厚さ0.04mmで、かつ実効直径、つまり弾性変形可能な領域が直径20mmとなるゴム膜で構成し、また流れ出し寸前、つまり弁体8との臨界状態(図2(イ))における球面の半径Rが26mmとなるように弁体8の下限位置を設定した本発明のインクカートリッジの水頭値の変化を示すもので、毎分5グラムという大量のインクを供給した場合にも、水頭値の増加が小さく、記録ヘッドでの大量のインク消費に対しても、記録ヘッドに過度な負圧を作用させることなく、スムーズにインクを供給できることが判

る。

【0026】他方、製造工程においてはインク供給口2をシール16で封止してインク室4に負圧を作用させてカートリッジ内の空気を排除する場合には、インク供給室5よりもインク室4の圧力が低下するため、図2(ハ)に示したように弁体8が弁体支持部材11の弾性に抗してインク室側に移動して膜弁座3と弁体8との間に空間を形成するから、膜弁座3及び弁体8の存在に関りなく、カートリッジ全体の空気を排除することができ、インク供給室5を含めてカートリッジ全体にインクを充填することが可能となる。

【0027】図4は、弁体8の他の実施例を示すものであって、この実施例においては弁体8の下面が膜弁座3に当接したとき、弁組立体9の上面に当接する平板状の位置決め片35が設けられている。

【0028】この実施例によれば、弁体8が膜弁座3に当接している状態では、位置決め片35が弁組立体9の上面に接触し、弁体3が弁組立体9に支持されて可及的に垂直な姿勢を維持するから、キャリッジの運動などによる振動に対しても確実に膜弁座3の通孔6を封止することができる。

【0029】図5は、本発明の他の実施例を示すものであって、図中符号20は、弁体で、弁組立体9に形成された弁体収容室9aに常時バネ21により下方に弾圧された状態で挿入され、また弁体収容室9aの下部の凸部9bに、弁体20に形成された位置決め片36が当接することにより下限位置が規定されている。なお、図中符号22、23はインク室4とインク供給室5とを接続する通孔をそれぞれ示す。

【0030】この実施例において、インク供給室5の圧力低下に対応して膜弁座3は、インク室4からの圧力を受けてその弾性により半径Rを持つ球面状に膨張しながら降下する。この時点では弁体20がバネ21の弾性により膜弁座3に追従し、また位置決め片36が凸部9bに当接して弁体20が垂直な姿勢に保持されるため(図6(イ))、インク供給室5の圧力が過度に低下するのを防止しつつ、インク室4からインク供給室5へのインクの流れ込みが阻止される。これにより、キャリッジの移動による揺動に関りなく、膜弁座3が弁体20に当接するため、記録ヘッドのインク圧力がインク室4に対して一定の負圧状態に維持される。

【0031】記録ヘッドでのインクの消費が進んで膜弁座3が一段と降下すると、弁体20が弁体収容室9aの突起9bにより一定位置以下に降下するのを阻止されるから、弁体8が膜弁座3から極わずかに離れる(図6(ロ))。これにより、インク室4のインクが弁体8と膜弁座3との間に形成された狭い間隙を経由して通孔6からインク供給室5に流れ込む。

【0032】インクの流入によりインク供給室5の圧力が若干上昇すると、膜弁座3が自身の弾性により弁体2

7

0側に移動して弁体20に弾接し、通孔6が弁体8の下  
面で塞がれる。これによりインク室4からインク供給室  
5へのインクの流れ込みが停止する。この結果、インク  
室3のインクの量に関りなく、インク供給口2の圧力が  
一定に維持されることになる。

【0033】他方、製造工程においてはインク供給口2  
をシール16で封止してインク室4に負圧を作用させて  
カートリッジ内の空気を排除する場合には、インク供給  
室5よりもインク室4の圧力が低下するため、図6

(ハ)に示したように弁体8がバネ21に抗してインク  
室側に移動して膜弁座3と弁体20との間に間隙を形成  
するから、膜弁座3及び弁体20の存在に関りなく、カ  
ートリッジ全体の空気を排除することができて、インク  
供給室を含めてカートリッジ全体にインクを充填するこ  
とが可能となる。

【0034】なお、上述の実施例においては、弁体20  
を膜弁座3に当接させる弾性部材を弁組立体9の中に組  
み込むようにしているが、図7に示したように弁体37  
を笠型に形成して、笠部37aを位置決め片及びストッ  
パとして機能させ、バネ38により頂点を膜弁座3側に  
弾圧するようにしてもよい。

【0035】この実施例によれば弁組立体9の外部から  
弁体37やバネ38を取付けることができるため、組立  
作業の簡素化を図ることができる。

【0036】なお、上述の実施例においては弁体上方  
にバネを設けるようにしているが、図8に示したように  
容器40を、通孔41aを備えた仕切り板41によりイン  
ク室42とインク供給室43とに分離し、インク供給  
室43に、膜弁座44と、下面に膜弁座44の通孔45  
を封止する球面46a及び球面46aから垂直に延びて  
膜弁座44の通孔45を貫通する支持部46bとからなる  
弁体46とを収容し、支持部46bを常時下方に弾圧  
するバネ47を介して支持するようにしても同様の作用  
を奏することは明らかである。なお、図中符号48は、  
支持部46bの下端と嵌合して弁体46を垂直な姿勢に  
位置決めガイド孔を、また49は、インク供給口を示  
す。

【0037】この実施例によれば、弁体46は、その下  
部をバネ47により下方に引かれるため、インクによる  
浮力に関りなく姿勢が安定するため、キャリッジの移  
動による揺動に関りなく、インクを記録ヘッドに安定  
に供給することができる。

【0038】図9は本発明の他の実施例を示すものであ  
って、図中符号50は、液面安定化膜で、膜弁座3の移  
動に追従できる程度の軟質性の多孔質体の膜や格子状の  
膜で構成され、弁体8に対向する領域には弁体8に嵌合  
する通孔51が形成されていて、周囲を組立体9に固定  
され、また中央部を弁体8に固定されている。

【0039】この実施例において、インクの消費の消費  
によりインク供給室5の圧力が低下すると、膜弁座3が

8

弁体8から離れてインク室4のインクが液面安定化膜5  
0を通過してインク供給室5に流れ込む。

【0040】さらにインクの消費が進んでインク室4の  
液面が組立体9近傍にまで低下すると、キャリッジの移  
動に起因して弁体8近傍でインクが激しく揺動するが、  
液面安定化膜50により圧力変動が可及的に抑えられて  
から膜弁座3の通孔6を通過することになり、インク室  
4のインク量の減少に拘わりなく記録ヘッドのインク圧  
が一定に保たれる。

【0041】なお、上述の実施例においては弾性手段を  
用いて弁体を膜弁座3に弾接させるようにしているが、  
膜弁座3自身の弾性力を積極的に利用すれば弁体を膜弁  
座3に弾接させる弾性部材を不要とすることができる。  
図10は弁体を膜弁座に弾圧する弾性部材を不要とした  
一実施例を示すもので、図中符号24は、膜弁座で、後  
述する弁体28と対向する領域に通孔25が形成され、  
周囲を弁組立体27により固定されている。28は弁体  
で、弁組立体27に垂直な姿勢となるように移動不能に  
固定されている。なお、図中符号29は、インク室4と  
インク供給室5とを接続する通孔を示す。

【0042】この実施例において、インク室4とインク  
供給室5との差圧が所定値以下の場合には、膜弁座24  
が自身の弾性により通孔25を弁体28に弾接するから、  
インク室4からインク供給室5へのインクの流れは  
停止する。

【0043】一方、インク供給室5の圧力が低下する  
と、膜弁座24が球面状に膨張しながら降下するため、  
通孔25が弁体28から離れ、インク室4からインク供  
給室5にインクが流れ込み、インクの供給が進んでイン  
ク供給室5の圧力が上昇した時点で、膜弁座24が差圧  
に打勝って弁体28に弾接してインクの流出を停止させ  
る。

【0044】ところで、記録ヘッドに空気が浸入する  
と、インク滴を吐出させるための圧力が空気に起因して  
記録ヘッドの流路内で発生した気泡に吸収されてしまっ  
て、印字不良を引き起こすため、インクカートリッジの  
インク終了時における記録ヘッドの空気吸い込みを防止  
する必要がある。

【0045】図11は、このような記録ヘッドのインク  
終了時における記録ヘッドへの空気の浸入を防止したイン  
クカートリッジの一実施例を示すもので、インク供給  
口52とインク供給室53との接続領域に上方が拡開す  
る円錐状の弁座54を形成して、ここに浮力により浮き  
上がる球状の浮き弁55を収容するとともに、上部をイン  
クが透過可能な網などの弁押え板56を設けて遮蔽弁  
が構成したものである。なお、図中符号57は、弁体5  
8に当接してインク室からのインクの流入を制御する膜  
弁座を示す。

【0046】この実施例において、インクカートリッジ  
が記録ヘッドに装着されている状態では、浮き弁55が

浮力により弁押え板56に張り付いた状態となり、インク供給口52が開放されて記録ヘッドへのインクの供給が行なわれる。

【0047】一方、カートリッジのインクの消費が進んで、インクの水位がインク供給口52近傍にまで低下すると、浮き弁55がインクによる浮力を失って弁座54に当接(図中、点線で示す状態)する。したがって、さらに印刷が進んだとしても、インク供給口52が封止されているから、記録ヘッドへの空気の浸入が阻止され、印字障害の発生を未然に防止することができる。

【0048】また、インクカートリッジは通常、記録ヘッドに装着されると、インク室のインクが消費され尽くされるまで、挿脱されるものではないが、それでも誤った操作により記録ヘッドから抜かれることがある。このように一旦、装着されたカートリッジが記録ヘッドから抜かれると、インク供給口2が大気開放されてインク供給室やインク室に空気が侵入して、記録動作に悪影響を与えることになる。

【0049】図12は、インクカートリッジの着脱に起因する上述の不都合を防止するための実施例を示すものであって、図中符号60は、インク供給口61に設けられた伸縮可能な弁体で、下部にインク供給針70が嵌合するインク供給針嵌合孔62が設けられている。また上限位置に移動したときインク供給室63とインク供給針嵌合孔62とを接続する通孔64が穿設されている。

【0050】この実施例において、常時は、図12(イ)に示したように弾性により弁体60がインク供給室63の底部63aに弾接してインク供給室63からのインクの流出を確実に阻止する。

【0051】インク供給針70が嵌合孔62に挿入されると、弁体60が上限位置にまで伸長してインク供給室63の底面63aから離れ、また連通孔64がインク供給室63に露出する(同図(ロ))。これによりインク供給室63とインク供給針70のインク流路70aとが連通孔64、70bを介して接続され、インク供給室63のインクがインク供給針70に流れ込み、記録ヘッドにインクが供給されることになる。

【0052】記録ヘッドに装着されたインクカートリッジが取り外されると、弁体60が下方に移動してインク供給室63とインク供給口61を遮断するから(同図(イ))、インク供給室63からのインクの流出とインク供給室63への空気の浸入が防止されることになる。

【0053】

【発明の効果】以上、説明したように本発明においては、底面にインク供給口を備えた容器を、中心部に通孔を備えた弾性薄膜からなる膜弁座により上部にインク室を、また下部にインク供給室を形成するように分割するとともに、通孔に対向する位置に弁体を設けたので、膜弁座が広い面積で差圧を受けて僅かなインクの消費に対応してインク室から流出するため、記録ヘッドに過度な

負圧を作用させることなく記録ヘッドにインクを供給できて、インク室のインクを無駄なく記録ヘッドに排出させることができるばかりでなく、印刷が中断されている状態で温度が大きく上昇した場合には、膜弁座がインク室側に変位して記録ヘッドと連通しているインク供給室の圧力上昇分をインク室に逃がすことができ、未使用時におけるインクの漏洩を防止でき、また記録ヘッドへの装着時には記録ヘッドとの間で印刷に適した負圧を維持して安定した印字を行わせることができる。

【0054】さらに膜弁座の弾性により弁体との密着性を確保できるため、キャリッジの移動に起因するインク室のインクの揺動に関わりなく、確実に弁機能を発現させることができ、キャリッジの移動に関わりなく記録ヘッドとの差圧を一定に維持することができて、印字品質の向上を図ることができる。

【図面の簡単な説明】

【図1】本発明の一実施例を示す断面図である。

【図2】図(イ)、(ロ)はそれぞれ記録ヘッドに装着された状態での膜弁座と弁体との動作を示す図であり、また同図(ハ)はインクカートリッジにインクを充填する場合における弁体の状態を示す図である。

【図3】本発明のインクカートリッジのインクの排出量と水頭値との関係を示す線図である。

【図4】本発明の他の実施例を、インク供給室近傍を拡大して示す図である。

【図5】本発明の他の実施例を示す断面図である。

【図6】図(イ)、(ロ)はそれぞれ記録ヘッドに装着された状態での膜弁座と弁体の動作を示す図であり、また同図(ハ)はインクカートリッジにインクを充填する場合における弁体の状態を示す図である。

【図7】本発明の他の実施例を、インク供給室近傍を拡大して示す図である。

【図8】本発明の他の実施例を、インク供給室近傍を拡大して示す図である。

【図9】本発明の他の実施例を、インク供給室近傍を拡大して示す図である。

【図10】本発明の他の実施例を、インク供給室近傍を拡大して示す図である。

【図11】インク供給口の実施例を示す図である。

【図12】図(イ)、(ロ)は、それぞれインク供給口の他の実施例を、記録ヘッドに装着されていない状態と、記録ヘッドに装着された状態とで示す図である。

【符号の説明】

- 1 容器
- 2 インク供給口
- 3 膜弁座
- 4 インク室
- 5 インク供給室
- 6 通孔
- 7 段差部

(7)

特開平8-174860

11

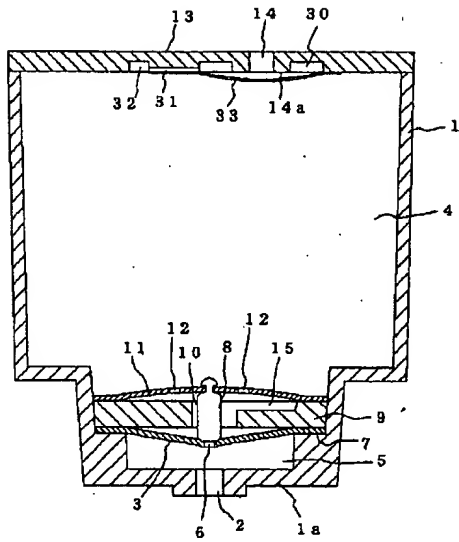
12

8 弁体

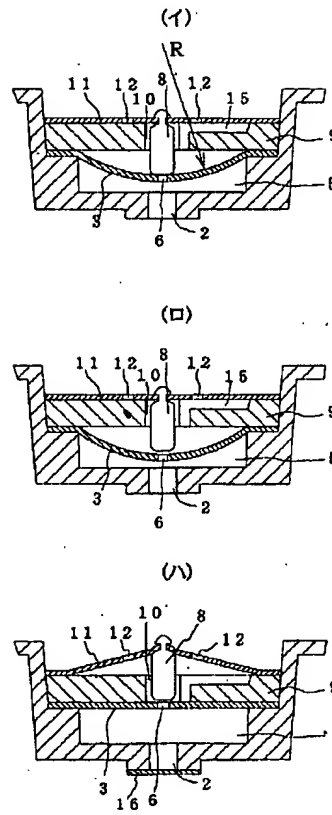
25 軟質多孔質体膜

9 弁組立体

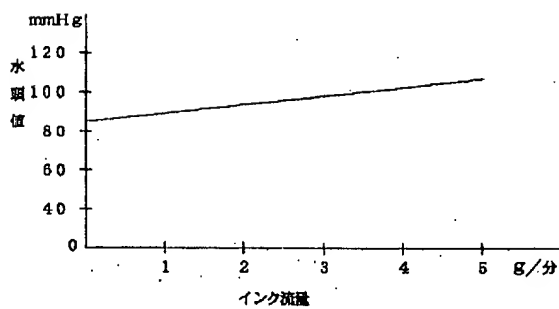
【図1】



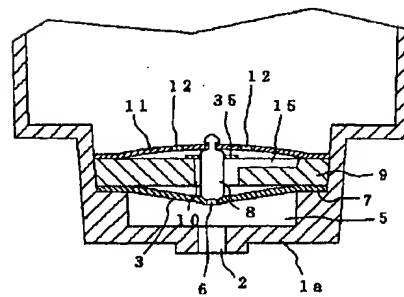
【図2】



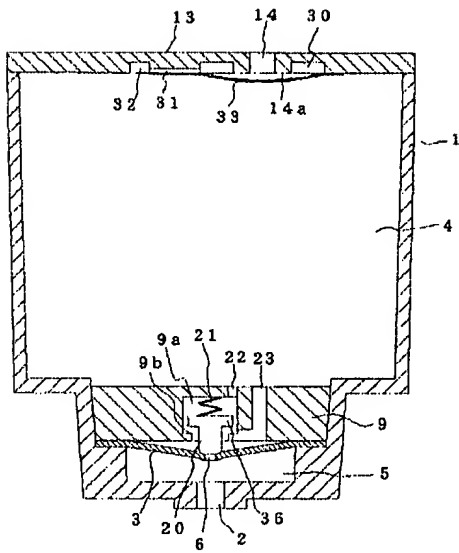
【図3】



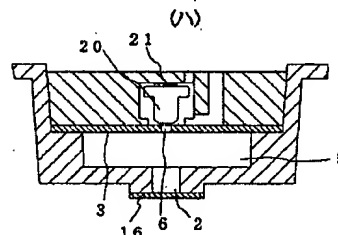
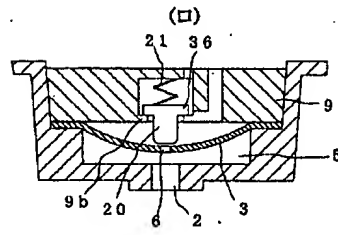
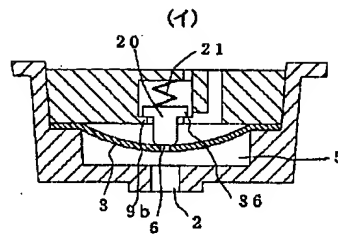
【図4】



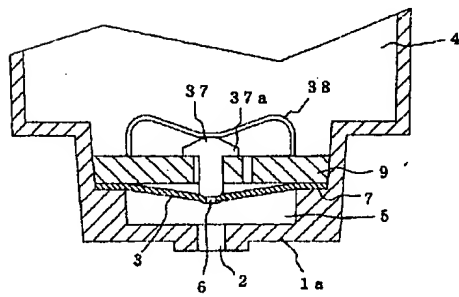
【図5】



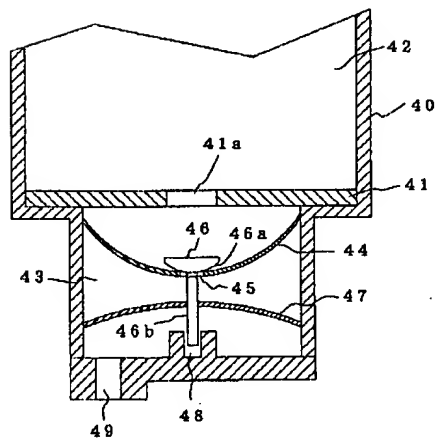
【図6】



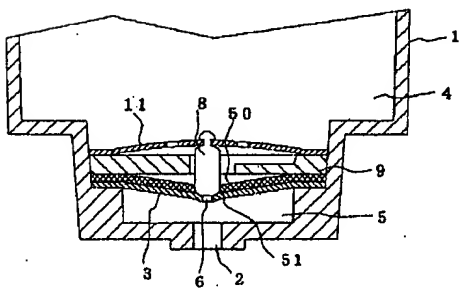
【図7】



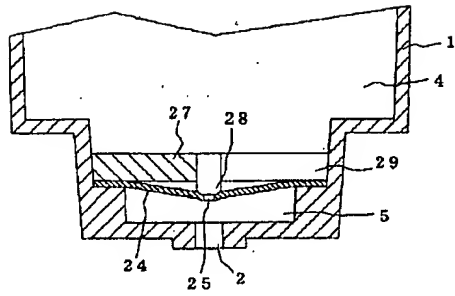
【図8】



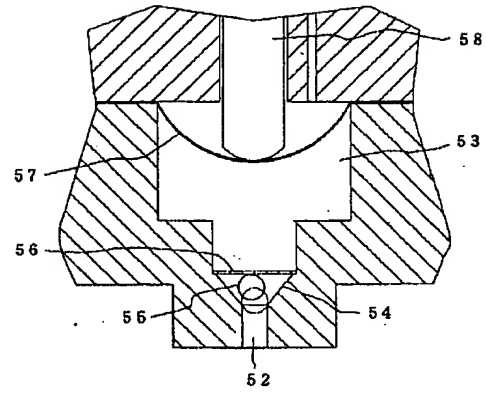
【図9】



【図10】

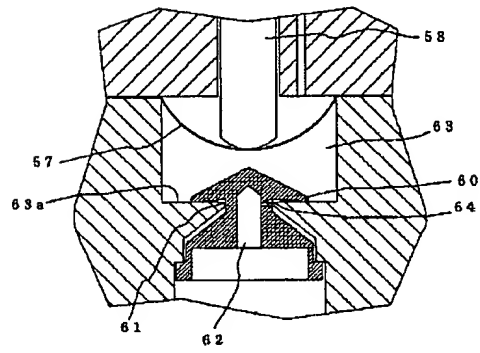


【図11】



【図12】

(イ)



(ロ)

